American Russian Environmental Services, Inc.

Pulsating Mixer Pump

Technology Need:

Cost efficient technologies are needed to effectively mobilize and retrieve settled solid wastes from tanks such as the Gunite and Associated Tanks (GAAT) at the Oak Ridge National Laboratory. Many of these tanks contain radioactive waste that consists of settled sludge covered by a layer of aqueous supernatant liquid with a vaporous air space above the liquid.

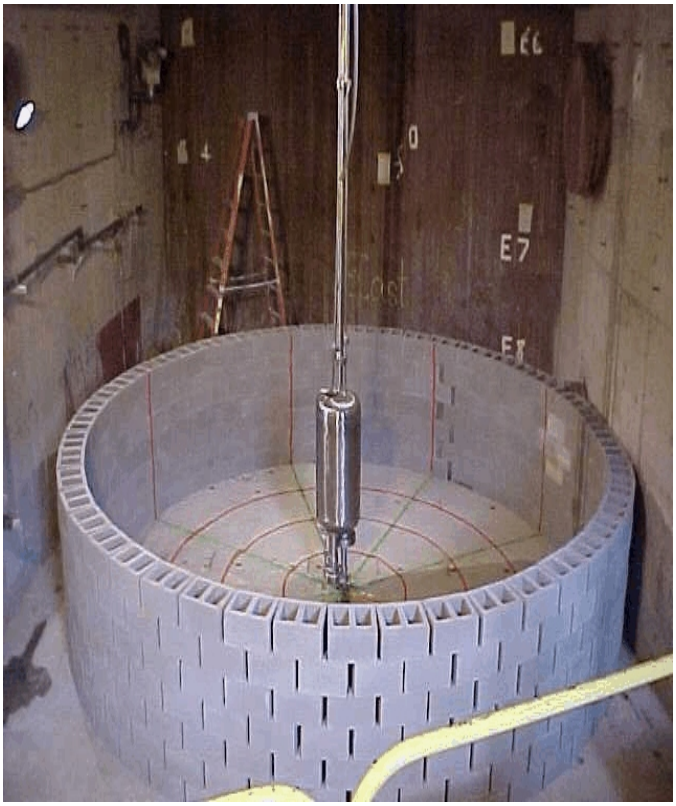
The baseline approach for sludge mobilization was a jet mixer pump. Jet mixer pumps have the following limitations, which the Department seeks to overcome. They:

- are expensive to purchase and install
- add heat to the tank waste
- have a limited operating lifetime
- may require frequent maintenance
- are difficult to dispose
- may not be able to mobilize all of the solids, depending on the waste characteristics.

Technology Description:

The pulsating mixer pump was developed by the Mining and Chemical Combine, a Russian Ministry of Atomic Energy nuclear installation in Zheleznogorsk, Russia for the mobilization of radioactive waste sludge in inactive underground storage tanks at the site. American Russian Environmental Services, Inc.(ARES), a consortium of Russian companies and national research organizations, was awarded a contract to evaluate the pulsating mixer pump for application at DOE radioactive waste tanks.

The pulsating mixer pump operates by drawing liquid waste into a vertical cylindrical pressure vessel through the perforated strainer (screened intake) and then expelling it forcefully through the discharge manifold. The discharge manifold directs waste through an array of four jet nozzles near the bottom of the waste tank to mobilize tank contents and scour the tank floor. The force from the jet nozzles breaks up settled sludge more effectively than mixers designed to recirculate liquid. With a compressed-air supply pressure of 90 pounds per square inch (psi), the pressure vessel takes about 35 seconds to fill and only 7 seconds to empty. This cycle is continuously repeated to create a pulsating mixing action. The entire mixer assembly rotates at prescribed rotation rates through a 90-degree arc on a swivel mounted on a platform-supported tank riser interface. The swivel enables the four fixed nozzles to complete a sweeping circular pattern on the floor of the tank.



The technology is expected to overcome many of the shortcomings of existing mixer pump systems. It has only one moving part immersed in the tank waste, minimizing the need for maintenance and disposal of in-tank components; it uses the tank waste as the working fluid, avoiding the addition of new fluid that would increase the volume of waste to be treated and disposed; it is expected to mobilize a larger volume of sludge than mixer pumps currently in use; and, its relative simplicity offers longer operating lifetime and lower overall maintenance requirements.

The in-tank mixer pump chamber consists of an upright cylindrical reservoir, a foot-check valve, a working gas supply pipe, a discharge manifold. and jet nozzles. In operation, the liquid or waste slurry is drawn into the pump chamber through the foot-check valve when the flow control unit supplies vacuum to the chamber. When the flow control unit provides pressurized air, the contents of the pump chamber are discharged back into the tank through the jet nozzles. The nozzles can be rotated to provide complete coverage of the tank. A drive screw system allows limited vertical adjustment to optimize placement relative to the tank floor.

Benefits:

- Reduces operation and maintenance costs (compared to other waste retrieval systems)
- Additional liquids are not introduced into the tank during the mobilization efforts
- Can be deployed in tanks through existing 24"risers
- Operates over a range of waste types (particle sizes, concentrations, densities, and mixture viscosities)
- Operates over a range of sludge heights and supernatant liquid heights
- Operable in a sweeping or stationary position
- Designed to withstand and operate in a tank waste environment of: 4°to 60°C (40° to 140°F); radiological exposure to 150 R/hr; and pH of 7 to 12

Status and Accomplishments:

The project was complete following the deployment of the Pulsating Mixer Pump System at Oak Ridge National Laboratory January 2001. The system was successfully operated to transfer the majority of the waste from tank TH-4 to the Bethel Valley Evaporator Service Tanks (BVEST). This project marks the first commercial deployment of Russian technology by the Environmental Management program.

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Online Resources:

Office of Science and Technology, Technology Management System (TMS), Tech ID # 2401 and #2370 http://ost.em.doe.gov/tms

The National Energy Technology Laboratory Internet address is http://www.netl.doe.gov

An Innovative Technology Summary Report (ITSR) for the Pulsating Mixer Pump technology may be viewed at:
http://apps.em.doe.gov/ost/pubs/itsrs/itsr2370.pdf